



Proteolysis and Tenderization in Angus, Brahman and Brangus is Related to pH Decline and Calpain-1 Autolysis

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Objectives

Early *postmortem* muscle pH decline influences protease activation and therefore tenderization. Brahman often shows slower proteolysis and less extended tenderization. The objective of this study was to determine pH decline, calpain-1 autolysis and protein degradation from Angus, Brahman and Brangus beef aged to 14d.

Materials and Methods

Steers used in this study were part of a long-term genetic study involving Angus, Brahman, and Angus-Brahman crossbreeding. Three genetic groups were used: Angus (A; 0.8 to 1), Brahman (B; 0.8 to 1) and Brangus (A 0.625; B 0.375). Steers ($n = 6$ per breed group) were harvested and the pH decline was assessed in the *Longissimus lumborum* at 1, 3, 6, 9, and 24 h *postmortem*. *Longissimus lumborum* muscle samples were collected at 1, 3, 6, and 24 h and 7 and 14 d *postmortem*. Western blotting was performed to evaluate calpain-1 autolysis and troponin-T degradation (TnT). Tenderization was assessed in aged steaks using Warner-Bratzler shear force (WBSF; 7 and 14d) and sensory analysis by a trained panel (14 d). Data were analyzed using SAS (SAS Inst. Inc., Cary, NC) and the model included the fixed effects of breed, time and their interaction. Time was considered a repeated measure (pH, calpain-1 and troponin-T). Means were compared using Tukey-test.

Results

Breed affected pH decline ($P = 0.049$). Brahman showed higher pH than Brangus, particularly within the first 6 h *postmortem*. Rate of autolysis tended to be different between breeds (breed \times time, $P = 0.06$). At 24h *postmortem*, Brangus showed greater calpain-1 autolysis compared to Brahman. Similarly, breed influenced the rate of TnT degradation during the aging period (breed \times time, $P = 0.001$). At 24 h, Brahman had less TnT degradation compared to Brangus, but not Angus. However, after 7d aging, Brahman had less TnT degradation than Angus; and at 14 d, Brahman showed less TnT degradation compared to both Angus and Brangus. No differences were found for WBSF-7d ($P = 0.092$) or WBSF-14d ($P = 0.292$) between breeds, but breed affected ($P = 0.004$) sensory tenderness.

Conclusion

Longissimus from Brahman exhibited slower rate of pH decline that coincided with slower tenderization, evidenced by reduced calpain-1 autolysis at 24h *postmortem* and less troponin-T degradation. Although breed did not affect WBSF, it decreased sensory tenderness, with Brahman beef considered slightly tough after 14d aging. The slower rate of acidification in Brahman indicates ATP levels are maintained longer; this may prolong calcium uptake by the sarcoplasmic reticulum and mitochondria, thereby delaying calpain activation and tenderization.